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AD HOC SUB-GROUP INTERIM REPORT ON NATIONAL TRAINING CENTER,(U)
SEP 80 R D O'NEAL, J FREEDMAN, R M LANGENDORF

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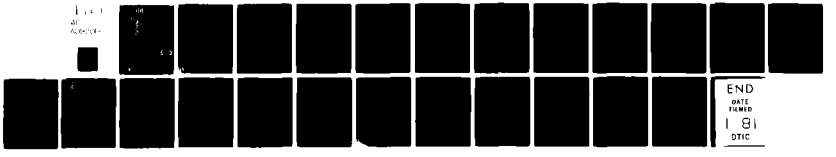

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DEPARTMENT OF THE ARMY
ASSISTANT SECRETARY OF THE ARMY
RESEARCH, DEVELOPMENT, AND ACQUISITION
WASHINGTON, D. C. 20310

ARMY SCIENCE BOARD

Ad Hoc Sub-Group
Interim Report
on
NATIONAL TRAINING CENTER

September 1980

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

National Training Center (NTC)
Instrumentation Technology
Phase I Instrumentation System
Phase II Instrumentation System
Second Generation NTC Instrumentation Support System
Troop Readiness
Training Instrumentation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document examines and reports on Army plans to use modern instrumentation technology to evaluate unit exercises at the Army National Training Center. The study intent was to focus on the second generation instrumentation support system, addressing technical feasibility and engineering realizability of meeting the schedule of implementation. Since a contract decision for Phase I has not yet been announced, it was infeasible to fully address

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the study terms. The study group will reconvene in November 1980 to assess potential impacts on Phase II and develop a final report.

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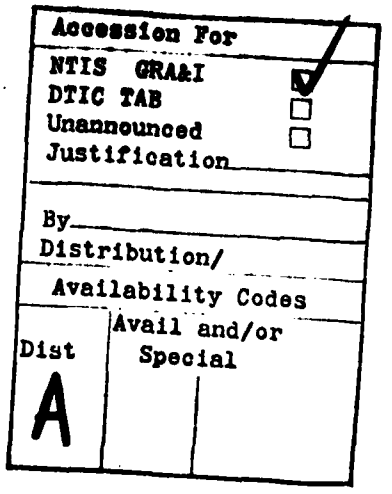

ARMY SCIENCE BOARD
Ad Hoc Sub-Group Interim Report
NATIONAL TRAINING CENTER

I. INTRODUCTION.

A. The Army Science Board (ASB) National Training Center (NTC) Ad Hoc Sub-Group (AHSG) is very much impressed with the potential of the NTC to significantly improve the readiness of Army troops to fight effectively. The U.S. is outnumbered by the Soviets in terms of equipment and it has been stated in recent testimony that the fielded Soviet equipment in many categories is superior to ours. The NTC concept, if properly implemented, gives the U.S. the opportunity to have a superiorly trained force. It, therefore, can be very critical in determining whether the U.S. wins or loses a war, if indeed it must fight one.

B. The charge to the AHSG to review the Army's NTC plans, focusing on the second generation instrumentation support system, is given in Appendix A, Terms of Reference (TOR). The AHSG, consisting of five ASB members, as shown in Appendix B, has held three meetings. The agenda for these meetings are included in Appendix C. The AHSG appreciates the time given by the NTC Program Manager (PM) and the NTC TRADOC Systems Manager (TSM) to furnish an understanding of a rather complex program. The NTC PM and TSM are to be commended for their grasp of the technical problems and the management of the program. Trips to Nellis Air Force Base and to Fort Irwin, CA, the site for the NTC, and to some contractor facilities were very useful in giving the AHSG an understanding of the status of the program and its relation to the Air Force programs at Nellis.

C. Many reports and documents were furnished to the AHSG, including:

1. The NTC Development Plan, April 1978.

2. The Request for Proposal (RFP) for the Instrumentation Center, 3 July 1980.

3. Environmental Impact Statement, NTC, Ft Irwin Site, January 1979.

4. Survey of Industrial Developers of Training Instrumentation System, System Planning Corporation (SPC), July 1978.

5. An assessment of Technologies Proposed for Phase II NTC, SPC, October 1979.

D. Although the total NTC effort will involve about $500M expenditure over the next five years, only about 5 percent of this

is required for the Phase I instrumentation system - which is, indeed, the key to making the NTC the very effective tool that we expect it to be. First instrumentation is scheduled to arrive in August 1981 and the instrumentation system is to be operational in April 1982 - an extremely ambitious schedule. The capacity of the NTC will gradually build to handle 42 Battalions for a two week training period each year.

E. Because the procurement contract for the system integration of the NTC instrumentation system has not been let and, consequently, the details of the system to be procured have not been specified and also because no detailed program has been laid out for Phase II, it is impossible for the AHSG to respond substantively to all the questions in the TOR. It is recommended that the AHSG have additional meetings after the contractor has presented the system configuration for the Phase I Instrumentation System and after other important events such as the Mobile Automated Field Instrumentation System (MAFIS) system concept review have taken place. This should permit answering the questions in the TOR in greater detail and, therefore, provide more meaningful advice. However, in order to be responsive to the request that a report be provided by the end of September 1980 so that the ASB's advice can be considered as the Fiscal Year (FY) 82 budget is developed, the AHSG is presenting in this report preliminary findings and conclusions and some recommendations for program actions and budgeting.

II. FINDINGS AND CONCLUSIONS.

A. The AHSG believes the NTC has the potential to make a significant improvement in the readiness of Army troops to fight effectively and therefore should be implemented as fast as possible.

B. The Phase I Instrumentation System concept seems reasonable and will be the key to NTC success - if properly implemented by the contractor. NTC - 1 Alpha tests lend credence to the soundness of the concept.

C. Specifications for the NTC Phase I Instrumentation procurement are performance objective oriented rather than detailed design oriented, thus allowing considerable flexibility for the contractor to reply to the RFP.

D. The schedule for hardware delivery and integration for Phase I Instrumentation is extremely short with first training using the equipment to start in about one year.

E. Phase II, for the most part, should be evolutionary with respect to Phase I. For this reason it is necessary that the Phase I be better defined before Phase II is detailed. Judgements on Phase II can best be made after the detailed design of the Phase I system is available from the Instrumentation System Integration contractor - probably after November 1980. Indeed, there are no Phase II programs and budgets upon which the AHSG can comment.

F. As a basic principle, the AHSG believes those parts of the Phase I Instrumentation System which have a high probability of working satisfactorily need not be replaced unless:

1. Better training can be achieved through more accurate (or rapid) measurement and realistic simulation of battlefield conditions.

2. Greater operational reliability can be achieved.

3. Savings can be achieved without degrading the quality of training or performance.

4. Reductions in size or weight can be made to a degree that enhances training or performance.

The PM has expected that the central computer center for Phase I will also be used for Phase II. Since the AHSG has not seen details of the contractor proposal, it cannot judge whether this is likely to be possible, but it is certainly desirable.

G. There are several alternative approaches which may be used in the Phase II subsystem areas. For example, in the position location subsystem a variety of techniques can possibly be used - Position

Location Reporting System (PLRS), MAFIS hyberbolic (LORAN), Global Positioning System (GPS), Range Measuring System (RMS), etc. Some, such as GPS, involve very advanced technology. The MAFIS, if developed, should provide much advanced technology which can be used for Phase II Instrumentation. It is intended that MAFIS will incorporate such advanced technology as magnetic bubble memory, packet radio techniques, and microprocessors. It uses distributed information processing. It is being developed for the U.S. Army Training and Doctrine Command Combined Arms Test Activity (TCATA) for testing, but could be adapted to training. It is not clear whether it will be affordable for training. As a result of the review of concept design in October 1980, it should be possible to obtain a better definition of the program - what it will do, when, and for how much. It is presently scheduled for system fielding in 1985.

The AHSG feels that the GPS offers some real advantages for providing location data and should be given very serious consideration for Phase II. The GPS should be available with 10 meter accuracy on a 2D basis in 1985 and on a 3D basis in 1987. Present estimates of cost for manpack and vehicle equipments seem reasonable.

Fortunately, both MAFIS and GPS developments are planned to be on a time scale compatible with NTC Phase II.

H. The AHSG sees as a principal problem the fact that the Multiple Integrated Laser Engagement Simulator (MILES) operates at a little under 1 micrometer and thus is incompatible with weapons systems using thermal imaging. The MILES may degrade significantly in the dirty battlefield environment and more rapidly than the weapons system using thermal imaging devices. The MILES contractor is aware of the problem and has some ideas on overcoming it; other scattered conceptual efforts and expertise also exist. However, some real work is required to obtain a better data base on the magnitude of the problem and to develop alternative solutions. It is not expected that this problem will be solved soon. Work needs to be started now in order to be reasonably certain that a solution will be available for Phase II.

The AHSG had done some thinking about the desirability of using millimeter or submillimeter frequencies. A real difficulty is whether one can design an antenna system small enough for anything other than vehicle mounted equipment; there is even concern that a small high resolution antenna could be mounted on vehicles in such a way as to assure reliability under all training conditions. Some small effort should go into studying what might be accomplished using a frequency in the 230 gigahertz range. However, it is most likely that the solution will be in the optical range of frequencies.

I. As a general principle, the scoring sensor should have a transmissivity through the dirty battlefield environment at least as good as, but preferably better than, the weapons system transmissivity.

J. Currently there appears to be no satisfactory method for simulating indirect fire and handling this in the play except through controllers. The development of a satisfactory solution to the problem of scoring indirect fire in the maneuver area should be a major objective of the Phase II Instrumentation system development.

The AHSG believes that as a general principle an attempt should be made to automate, as much as possible, the functions performed in Phase I by the controller. This applies not only to indirect fire, but also to nuclear, biological, and chemical (NBC) weapons play and to the play of mines.

K. Displays will play a very strong part in presenting information in such a manner that it can be absorbed so that training takes place. This is particularly true for the Field Training Feedback System where after-action reports will be presented and studied. The AHSG cannot say how adequate the designs are because not even the Phase I design has been detailed. It is an area that should be reviewed carefully in the Phase I design configurations.

L. A lack in Phase I is the capability for having an assessment of intervisibility between individual participants such as tank to tank. It is expected that the intervisibility can be determined for units of participants such as Companies. This may be sufficient, but an analysis is necessary to determine if this is so. If not, provision must be made for intervisibility between individual participants in Phase II.

M. The phrase "train as we will fight" is meaningful only if it is done. The AHSG has been told that this will include fighting at night using night vision equipment; fighting under simulated NBC conditions; fighting under dirty conditions, including the use of smoke; fighting in the presence of and with mines or simulants thereof; fighting in an electronic warfare (EW) environment; the use of close air support, etc. While the AHSG was told that all this will be included, a detailed plan of how and when each of these will be introduced in Phase I has not been provided and, therefore, where the weaknesses may be that should be corrected for Phase II.

N. In Phase II it may well be desirable and necessary to provide for more than 500 participants.

O. It is important to have close coordination between the Army and the Air Force, not only because of the need to have play with close air support if the two Services are going to "train as they will fight", but also because each Service has developments that can be useful to the other. There seems to be coordination at lower levels, but high-level coordination is needed to give proper attention to priority of resources.

P. There are no plans to train in simulated built-up areas in the NTC. The lack of a MOUT (Military Operation in Urbanized Terrain) environment is where NTC varies most from "training as we will fight". It is the AHSG's understanding that MOUT training is being performed elsewhere and at the Company level of training. Neither the Phase I nor Phase II Instrumentation systems will include MOUT constraints and requirements.

Q. The NTC environment is austere and isolated. The quality of the physical environment in the cantonment area will be important for the permanent party, and particularly important for the Opposing Force (OPFOR) which will be operating under highly stressed conditions for extended periods of time. Planning and budgeting to meet these needs according to 1980 standards warrants high priority. In particular:

1. Troop housing needs to be substantially upgraded. Current plans appear adequate, but warrant accelerated implementation.

2. Family housing needs rehabilitation. Equally important, contemporary civilian standards of neighborhood planning should be reflected in planning and budgeting, so as to bring existing and future housing areas up to such standards as soon as possible. In particular, this will require that some community facilities be built within family housing areas.

3. Community facilities to support the full permanent party need upgrading. This should be planned, budgeted, and implemented on a timely basis.

R. During the operation of the NTC much data will be collected which can be important in studying the Army as a system - with the objective of improving organization, tactics, materiel, and training. Planning should be initiated early to determine the impact of such considerations on storage and availability of Phase I data and on Phase II system design and data analysis.

S. The essentially empirical Phase I approach to the selection of instrumentation and definition of data requirements appears sound and practical in light of the current circumstances. However, as the opportunity arises to evaluate the relevance and usefulness of the Phase I data and to plan for Phase II, it becomes important to complement such an approach with a more systematic, integrative approach to defining data requirements and their impact on future instrumentation.

T. In the various documents which the AHSG received on the NTC, such as SPC's "An Assessment of Technologies Proposed for Phase II - National Training Center", there is no reference to an overall conceptualization for the instrumentation program. The closest thing to such an approach appears on Pages III-4 to III-11 of the Developmental Plan. That section outlines a strategy for developing a methodology for making measurements, using a "top-down analysis". The analysis is made in terms, first, of the missions of a military unit, then the tasks, then the essential elements analysis, then the measures of effectiveness, then the measures of performance, and finally the data, which are facts or statistics that provide descriptive information pertaining to a single event. These are viewed as a hierarchy. This approach also deals with the five levels of evaluation: execution, control, coordination, support, and plan. The section indicates, correctly, that it is necessary to have a pilot phase in developing measures; then a model phase to analyze the missions and tasks of various elements in the system evaluated; and then a phase in which measures that are developed are tested against data derived from early NTC operations. All of this, however, does not give a rationale for the selection of the particular variables to be measured which then leads to the selection of particular instruments. Such a conceptualization is needed.

III. PRELIMINARY RECOMMENDATIONS. Substantive comments answering the three questions in the TOR can be made only after the Phase I Instrumentation System has been more clearly defined by the systems integration contractor. This probably can be done better in December 1980 or January 1981. The AHSG would like to express preliminary thoughts in the following recommendations.

A. The U.S. Army Training and Doctrine Command (TRADOC) and Office Deputy Chief of Staff for Operations and Plans (ODCSOPS) should continue to place strong priority on defining and procuring Phase I Instrumentation. The presently planned delivery dates are scheduled so tightly as to border on being unrealistic. However, it is very important to have the system as soon as possible. Because of the high payoff expected from this program, the NTC should continue to rank among the Army's highest priorities.

B. At the same time, and in spite of the pressures on the NTC TSM's office to implement Phase I, effort must start on Phase II and TRADOC should budget some money in FY 82. Reprogramming may be required to accommodate time constraints. Funding for future years should be provided in the budget process. Although the investment in Phase II instrumentation will comprise a small fraction of the overall NTC costs, it can have a high leverage on the effectiveness of the training. The following should be accomplished or initiated with FY 82 budgeting at a level of $5 million:

1. A program should be undertaken to develop an integrative, conceptual approach to analyze the Battalion as a system. This would study the interactions of its human and technological subsystems and components -- at the levels of the individual soldier, the Squad, and higher echelons of command -- with its environment. Flows of personnel, materiel, and information into, through, and out of the system should be investigated. On the basis of such studies, critical variables of the Battalion-environment interaction would be identified; these should be continuously measured by planned instrumentation during future exercises at NTC.

2. Studies should determine the advisability of using MAFIS subsystem technology, as well as other advanced technologies, for Phase II training. These studies should address the modifications that might be made to perform the training function more effectively. The timing, which includes having a Phase I system definition by October 1980, is favorable for completing a MAFIS-oriented study in FY 82.

3. An analysis should determine the seriousness of the MILES laser frequency being different from that of the thermal imagers and thus degrading the utility of MILES. Also, alternatives to the MILES transmitters and detectors should be developed to eliminate this problem, which at the present time seems to be the most severe problem in the entire system and which affects both Phase I and Phase II.

4. TRADOC should develop one or more approaches to the indirect fire scoring problem.

5. The TSM should program exploratory development in such areas as improved 3D presentation.

C. After the Phase I contractor has been selected and the final Stanford Research Institute (SRI) report on Time Space Position Information (TSPI) systems has been reviewed by the Air Force, the Army and Air Force should hold joint coordination meetings to discuss how each may benefit from the other's development programs. At such a meeting or at a separate meeting the two Services should plan on how the Nellis and George Air Force Bases forces could best assist training at NTC. At both meetings high-level participation by both Services is important to identify and allocate resources.

D. ODCSOPS should perform planning studies to determine what has to be done to insure that the data required for studies of the Army as a system are collected and preserved for such studies.

1. It appears that an enhanced level of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) or equivalent contractual effort is desirable both to support Phase I and to prepare a sounder foundation of planning for Phase II. To achieve this, additional resources must be allocated.

2. Early, more active participation of appropriate organizations with NTC Phase I development and planning for Phase II is desirable to enhance usability of NTC data for evaluation of doctrine and combat development and to support Phase II planning.

E. The family housing rehabilitation needs and the community facilities to support the full permanent party should be budgeted and implemented on a timely basis.

APPENDIX A
TERMS OF REFERENCE

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

REPLY TO ATTENTION OF

16 MAY 1980

Dr. J. Ernest Wilkins, Jr.
Associate General Manager
EG&G Idaho, Incorporated
Post Office Box 1625
Idaho Falls, Idaho 83401

Dear Dr. Wilkins,

Request that you empanel an Ad Hoc Sub-Group of approximately eight Army Science Board members to examine Army plans to use modern instrumentation technology to evaluate unit exercises at the Army's National Training Center (NTC). The review should focus on the second generation instrumentation support system, addressing the technical feasibility and engineering realizability of meeting the declared schedule of implementation. Some background literature is attached.

As additional background, please note that:

1. The highest priority Army training initiative is to establish the NTC at Fort Irwin, California. The NTC would provide an area where battalion task forces can be evaluated to gather hard data about battlefield performance and combat effectiveness of organizations and systems under realistic conditions. The battalion task force is the lowest level with a staff to coordinate the complex arms elements of combat power.

2. Since combat conditions are to be duplicated with fidelity at the NTC, battle realism evaluation, and feedback in this environment require comprehensive instrumentation and computer support to provide objective, detailed, and timely assessment of unit performance. Such instrumentation provides the ability to address questions of force readiness and effectiveness of doctrine, organizations, equipment, and training techniques.

3. The NTC instrumentation and control system is designed to collect and report data, enhance overall realism, control the exercise, record and process collected data, and generate displays for review and evaluation. For those actions which are not suitable for direct instrumented collection, controllers will collect data off-line. Instrumentation will include time-space position location, targets, key event recording, voice

and video recording, and appropriate analysis and playback facilities. Initial instrumentation (Phase I) has been demonstrated and is under procurement. It is scheduled to be operational by April 1982. Later Phase II instrumentation would replace or supplement Phase I hardware with advanced technology equipment in FY 85 and beyond.

4. Instrumentation procurement and R&D funds are programmed as follows ($ millions):

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85	FY 86
OPA	10.3	4.8	8.8	0.2	0	0	0
RDT&E	0	0.5	0	0.5	0.5	0.5	0.5

NOTE: Phase II procurement would involve significantly increased post-FY 86 funding.

The sub-group should address these Terms of Reference:

1. Are currently planned Phase II programs and budgets technologically sound, reasonably manageable, and logically structured to achieve target milestones? Is the proposed expansion realistically phased and funded?

2. What other technologies could be applied to second generation NTC instrumentation support systems to efficiently provide quality Phase II instrumentation? Which research and development options, with milestones, should be integrated into the Phase II plan?

3. What development, engineering, and technical management adjustments should be made to facilitate integration of future technical considerations into the planning, programming, and budgeting system?

I would appreciate a report on the National Training Center Phase II instrumentation system by the end of September 1980, so that the Army Science Board's advice can be considered as the FY 82 budget is developed.

Sincerely,

Percy A. Pierre
Assistant Secretary of the Army
(Research, Development and Acquisition)

2 Inclosures
1. Pamphlet, NTC, Sep 79
2. NTC Development Plan, HQ TRADOC, 3 Apr 79

APPENDIX B

PARTICIPANTS

ASB Ad Hoc Sub-Group on National Training Center

DR. RUSSELL D. O'NEAL, CHAIRMAN
PRIVATE CONSULTANT
897 GREENHILLS DRIVE
ANN ARBOR, MI 48104
(313) 994-0643

MR. JEROME FREEDMAN
ASSISTANT DIRECTOR
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY
POST OFFICE BOX 73
LEXINGTON, MA 02173
(617) 862-5500 X343

DR. RICHARD M. LANGENDORF
PROFESSOR OF ARCHITECTURE & PLANNING
UNIVERSITY OF MIAMI
SCHOOL OF ENGINEERING & ARCHITECTURE
POST OFFICE BOX 248294
CORAL GABLES, FL 33124
(305) 284-3438

MAJ ROBERT L. HERNDON, STAFF ASSISTANT
TRAINING SUPPORT DIVISION
OFFICE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
THE PENTAGON, ROOM 2E661
WASHINGTON, DC 20310
(202) 694-5100

DR. JAMES G. MILLER
PRESIDENT
UNIVERSITY OF LOUISVILLE
2301 SOUTH 3RD STREET
LOUISVILLE, KY 40208
(502) 588-5417

DR. IRENE C. PEDEN
PROFESSOR OF ELECTRICAL ENGINEERING
UNIVERSITY OF WASHINGTON
SEATTLE, WA 98195
(206) 543-8025

APPENDIX C

MEETINGS CONDUCTED

NATIONAL TRAINING CENTER
AGENDA
ROOM BF 746

11 JUNE 1980		
0830-0930	Army Training in General	COL Whiddon
0930-1015	NTC Plans	BG Bramlett
1015-1130	NTC Instrumentation	COL Edwards
1130-1230	Lunch	
1230-1330	Live Fire Ranges	COL Szvetecz
1330-1430	Soviet Training	
1430-1630	Discussion	
12 JUNE 1980		
0830-1030	Harry Diamond Lab	Mr. Johnson
1030-1200	Discussion	

ARMY SCIENCE BOARD AD HOC SUB-GROUP ON NATIONAL TRAINING CENTER
Itinerary - 8-11 July 1980

8 July

Members arrive by commercial means at Las Vegas, NV. Overnight at Ambassador Hotel ($22/night), 377 E. Flamingo Road, tel (702) 733-7777

9 July

0700	Check out of hotel and load sedans
0720	Depart hotel for Nellis AFB
0750	Arrive Bldg 102, Nellis AFB
0800-0845	HEMI briefing
0845-0920	Red Flag briefing
0930-1130	Range instrumentation briefings
1130-1230	Lunch
1230-1600	Drive to Barstow, CA. Overnight at Holiday Inn ($30/night), 1520 East Main Street, tel (714) 256-6891

10 July

0725	Check out of hotel and load sedans
0745	Depart hotel for Ft Irwin
0830	Arrive Ft Irwin
0840-0900	Courtesy call on BG Bramlett and COL Taylor, Ft Irwin NG Cdr
0900-0945	Tour of facilities - BG Bramlett
1000-1200	Helicopter tour of Ft Irwin - BG Bramlett
1200-1245	Drive to Barstow
1245-1345	Lunch
1345-1600	Drive to Pasadena, CA. Overnight at Huntington Hotel ($31/night), 1401 South Oak Knoll, tel (213) 792-0266

11 July

0740	Check out of hotel and load sedans
0800	Depart hotel for Jet Propulsion Laboratory (JPL) (4800 Oak Grove Dr)
0830	Arrive JPL
0845-1130	JPL, MAFIS & GPS briefings (Mr. Crabtree, LTC Florio and LTC Goldtrap)
1130-1230	Lunch
1230-1300	Enroute to Xerox
1300	Arrive Xerox Electro Optics (300 North Halstead St., Pasadena)
1315-1600	MILES briefings - Mr. Tallman
1600-1700	Sedans take members to LAX for return commercial transportation

Escort officers: MAJ Bob Herndon, HDDA, DAMO-TRS tel (202) 694-5100
COL Dick Edwards, HQ TRADOC, ATTG-C tel (804) 727-3555/2936
at Nellis AFB: MAJ Sagers, Army LNO Autovon 682-2266
at Ft Irwin: BG "Tim" Bramlett, NTC Cdr (714) 256-1711

Army Science Board Ad Hoc Sub-Group On
National Training Center

ITINERARY 18-19 August 1980

18 August (Room 2E271, Pentagon)

0830-1130 Army Research Institute - Dr. Jim Banks

1130-1230 Lunch

1230-1630 Executive Session

19 August

0830-1130 Briefings by System Planning Corporation in 13th floor conference room, 1500 Wilson Blvd., Arlington, VA

1130-1300 Lunch and return to Pentagon

1300-1630 Executive Session (Room 2E271, Pentagon)

Escorts: COL "Dick" Edwards - TRADOC NTC TSM
LTC Bob Keenan - HQDA DAMO-TRS

APPENDIX D

ACRONYM DEFINITIONS

AHSG	Ad Hoc Sub-Group
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ASB	Army Science Board
EW	Electronic Warfare
FY	Fiscal Year
GPS	Global Positioning System
LORAN	Long Range Navigation System
MAFIS	Mobile Automated Field Instrumentation System
MILES	Multiple Integrated Laser Engagement Simulator
MOUT	Military Operation in Urbanized Terrain
NBC	Nuclear, Biological, and Chemical
NTC	National Training Center
ODCSOPS	Office Deputy Chief of Staff for Operations and Plans
OPFOR	Opposing Force
PLRS	Position Location Reporting System
PM	Program Manager
RFP	Request For Proposal
RMS	Range Measuring System
SPC	System Planning Corporation
SRI	Stanford Research Institute
TCATA	U.S. Army Training and Doctrine Command Combined Arms Test Activity
TOR	Terms of Reference
TRADOC	U.S. Army Training and Doctrine Command
TSM	TRADOC Systems Manager
TSPI	Time Space Position Information

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